Annual Project Summary

Quaternary Geologic and Geomorphic Mapping of the Rodgers Creek Fault Sonoma County, California

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Investigations Undertaken

The 60-km-long Rodgers Creek fault, located between San Pablo Bay and Santa Rosa, California, strikes approximately N35°W, and is characterized by a late Holocene right-lateral slip rate of 6.4 to 10.4 mm/yr (Budding et. al, 1991; Schwartz et. al, 1992). The Rodgers Creek fault is one fault in a series of right-stepping *en-echelon* faults that include the Hayward fault to the south, and the Healdsburg and Maacama faults to the north (Figure 1). The surface expression of the Rodgers Creek fault, as mapped by Randolph and Caskey (2001) and Hart (1992), includes classic geomorphic features such as offset drainages, sidehill benches, tonal lineaments, sag ponds, and springs.

Paleoseismic investigations have occurred at four locations along the central and southern part of the fault (Triangle G, Beebe Ranch, Martinelli Ranch, and the Donnell Ranch sites). Two of these studies indicate a geologic slip rate of 6.4 to 10.4 mm/yr along the fault, with a recurrence interval of 131 to 370 years, and a best estimate of 230 years (Budding et. al, 1991; Schwartz et. al, 1992). Historically the Rodgers Creek fault has been seismically quiescent, with the 1969 (M_L 5.6 & 5.7) events occurring near the city of Santa Rosa, and possibly the Mare Island event of 1898 (M 6.2-6.7) being the only moderate to large earthquake events documented along or near this fault.

The Working Group on California Earthquake Probabilities (WGCEP, 2002) have defined the Hayward-Rodgers Creek fault system as having the greatest probability (27%) of generating a M $\geq$ 6.7 earthquake within the next 30 years. One scenario shows the Rodgers Creek fault rupturing in its entirety along with the Hayward fault to produce an earthquake as large as M 7.4. However, data used to develop the probabilities for the Rodgers Creek fault are based on findings from only two studies along the central fault trace (Budding et. al, 1991; Schwartz et. al, 1992).

The lack of detailed Quaternary geomorphic and geologic mapping along the active faults in the San Francisco Bay area has led to inadequate characterization of the faults. Compilation of existing detailed mapping along the length of the Rodgers Creek fault has not been completed to date. For this investigation, we have compiled the existing published data for the entire length of the Rodgers Creek fault, and input the data into a GIS database to be incorporated into the community Quaternary fault database for the San Francisco Bay Area.

Results

This project has contributed to the existing knowledge of the Quaternary behavior for the Rodgers Creek fault by compiling a detailed digital fault database. This effort has yielded a digital product that is being incorporated into the Quaternary fault database for the San Francisco Bay Area. The database has been compiled based on work by many authors, including: Randolph Loar (2002); in process mapping by CGS (multiple authors, 2002); Hart (1992); CGS (formerly CDMG, 1982); Herd (1978); and Helley and Herd (1977).

This study has evaluated and documented the physical characteristics of the Rodgers Creek fault and included the task of annotating more than 3300 fault segments, with a main objective of identifying the rate of activity for each fault strand (i.e. an age estimate) based on several factors. Direct evidence for recency of fault activity (paleoseismic studies) and indirect evidence

(mapped geomorphic features) were the primary methods used to determine the age estimate for each fault strand. Additionally, interpretations for the age of each of the fault strands have been based on the information from the available published maps, as well as by comparing the mapped fault data with 1:6,000 scale air photos that have been taken along the length of the fault.

Other fields that have been completed in this database include:

- Fault name (i.e., Rodgers Creek, Tolay, and Bennett Valley)
- Comment on fault name (only filled in when appropriate, i.e., local fault name)
- Fault rank (i.e., primary, secondary, tertiary, questionable)
- Age estimate (i.e., Holocene, potentially Holocene, Quaternary, potentially Quaternary, and pre Quaternary)
- Geomorphic annotation for recently updated traces that differ from the 1:24,000 published Hart (1992) map
- Author of mapping and year published
- How the fault was mapped.(i.e., air photos, field mapping, etc)

The primary focus for this project was to populate the Age Estimate field in anticipation of the completion of a Quaternary fault map for the entire Bay Area using this data for each of the mapped faults in the region. Continued work on this database for the Rodgers Creek fault would consist of adding more detail regarding the geomorphic annotations and completed paleoseismic studies along the fault, as well as continued refinement of identified Holocene active fault traces.

Non-technical Summary

This research provides data to be incorporated into the community Quaternary fault database for the San Francisco Bay Area mapping project. All data was compiled from available resources and entered into a fault database. This resulted in a database with over 3300 fault segments that have been interpreted and identified by the authors as Holocene, potentially Holocene, Quaternary, and potentially Quaternary active fault strands.

Reports Published

None.

Data Availability

The product of this research is a GIS database that has been incorporated into the Quaternary fault database.

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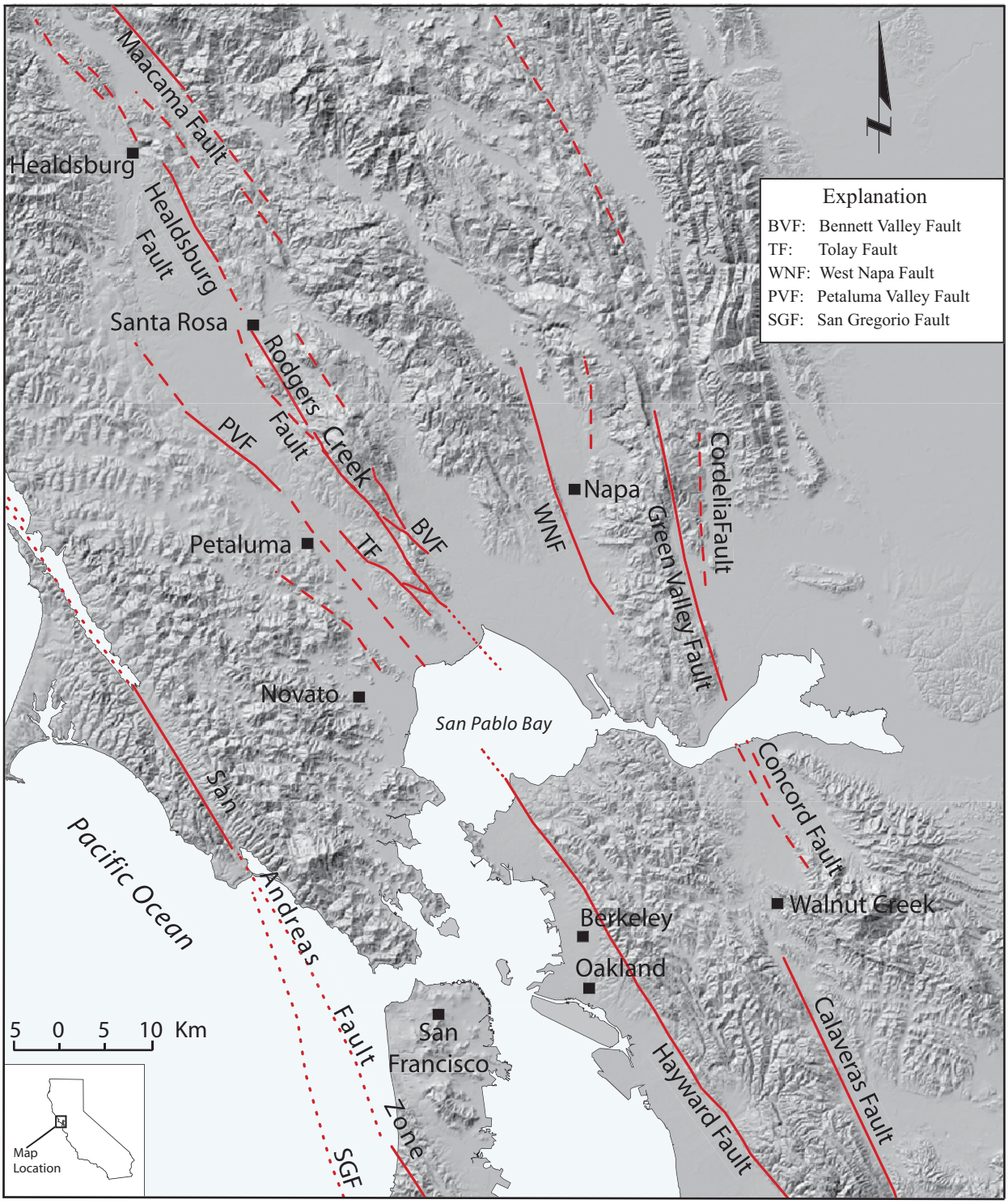

Figure 1 Regional Location Map showing faults modified from Jennings (1994).